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E1T T2H T2J T5C1 T5E1 T7CX T7C2 T8B

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GB 2234544 A GB 2177447 A GB 2062079 A
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US 4015383 S US 3824751 A

(58) Field of Search
UK CL (Edition L) E1D DDP DF185 DGS , E1T
INT CL[5] E02D , E04H

(54) Water-tight building structures

(57) A water-tight building structure comprises a peripheral foundation member (24) having a channel (26) in its upper face in which is received the lower edges of pre-cast, pre-stressed wall sections (40) which are pulled together to compress sealing means therebetween to provide a water-tight wall. A concrete floor slab (60) is cast on a water-tight layer or membrane (50).

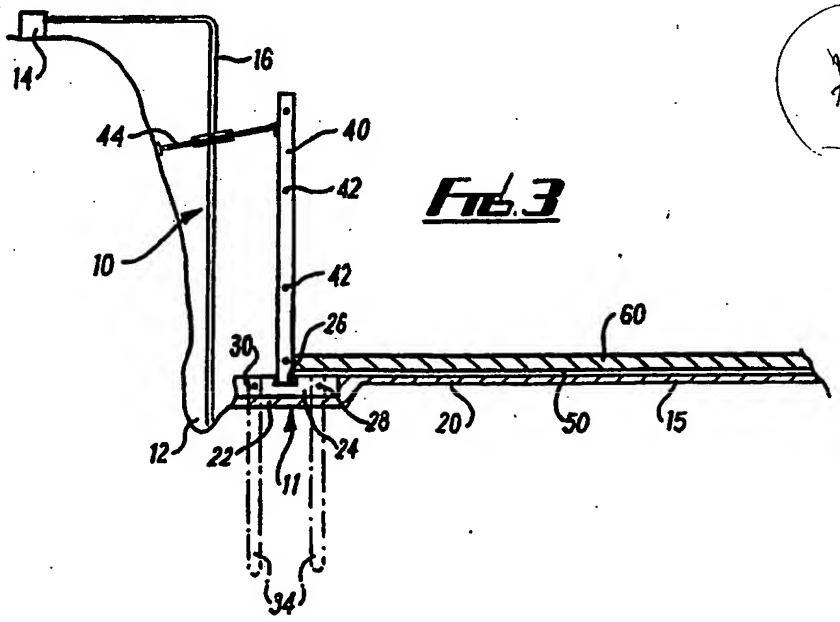

FIG.3

The references to figure 6 of the drawings in the printed specification are to be treated as omitted under Section 15(2) of the Patents Act 1977.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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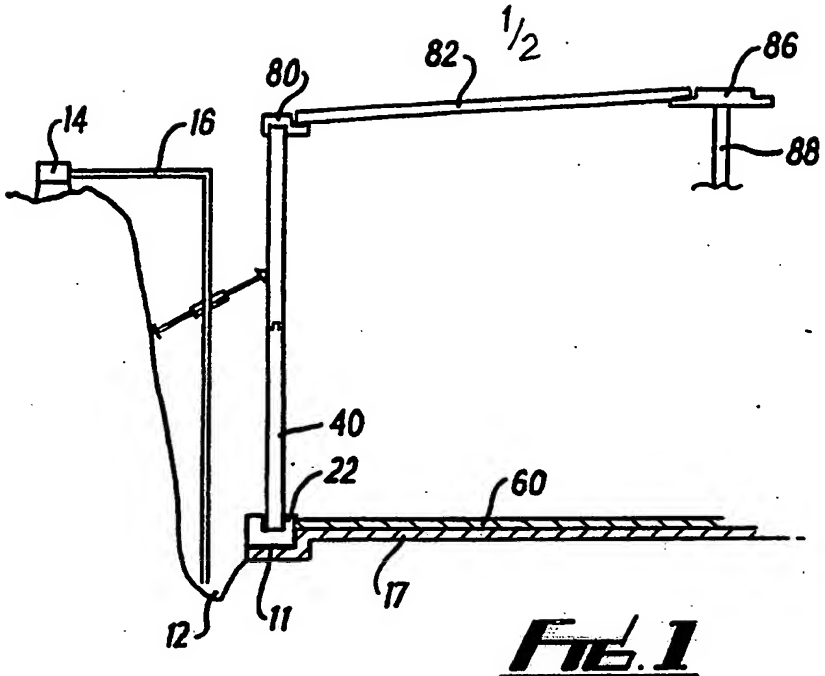

FIG. 1

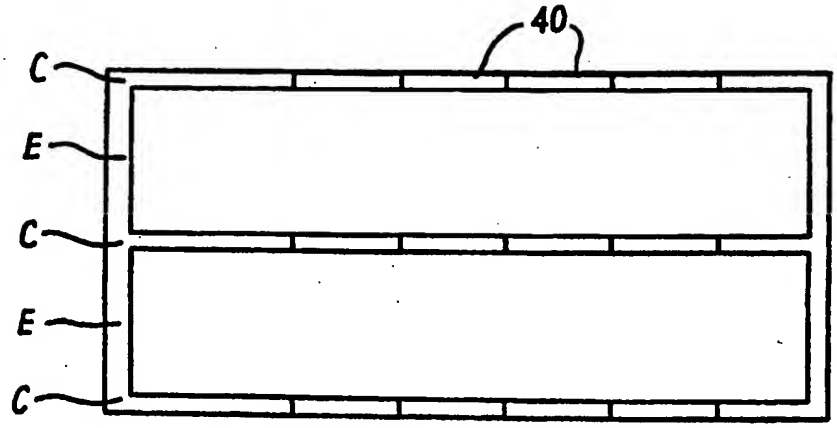

FIG. 2

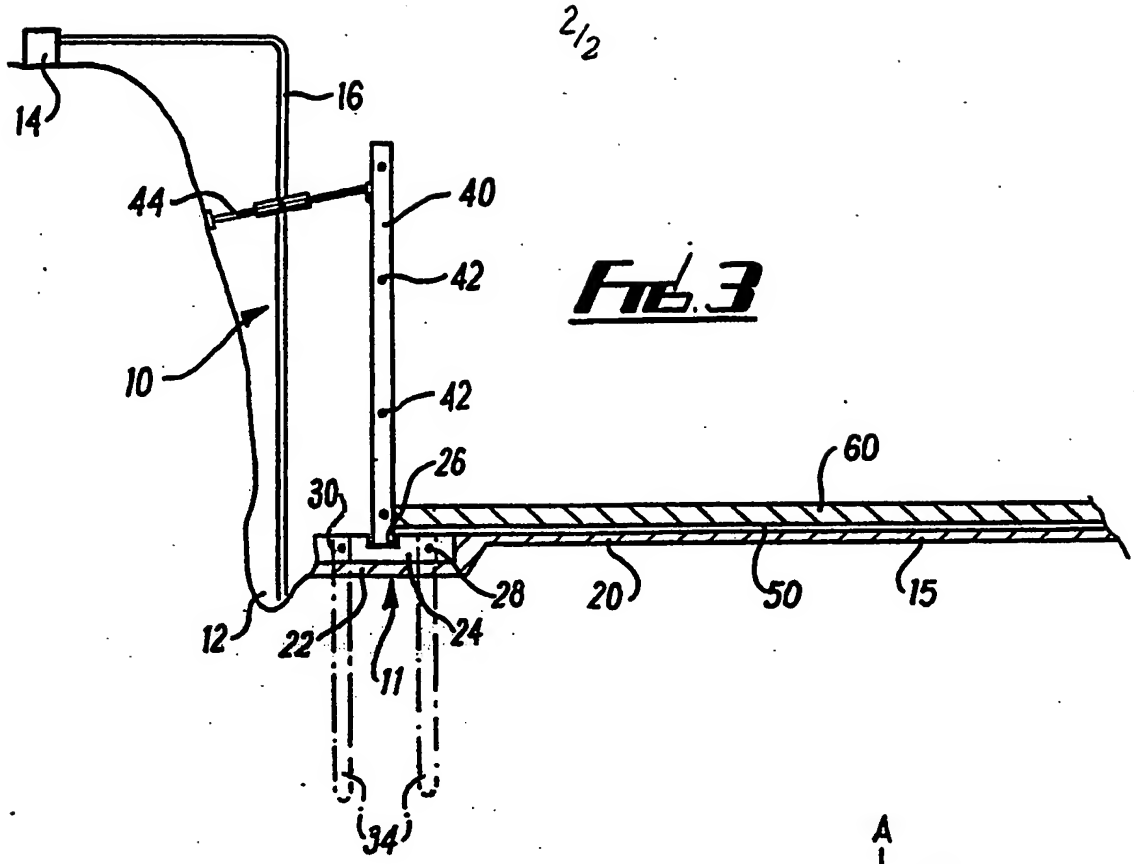

FIG. 3

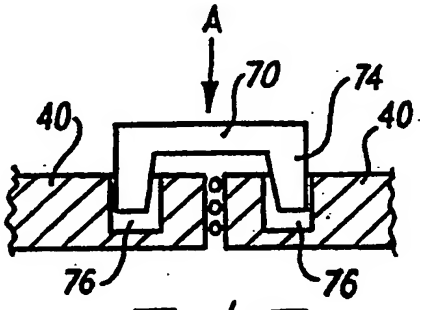

FIG. 5

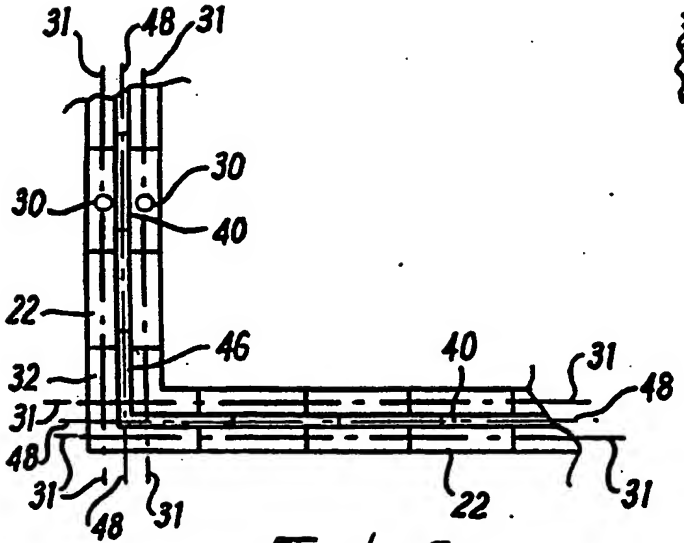

FIG. 4

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IMPROVEMENTS IN OR RELATING TO WATER-TIGHT BUILDING STRUCTURES

The present invention concerns improvements in or relating to water-tight building structures, especially but not exclusively water-tight building structures for example tanks and basements fabricated generally from reinforced concrete.

Our U.K. patent application 9205677 describes a water-tight enclosure which we devised with a view to obviating and mitigating a number of the disadvantages inherrent in existing enclosures. For building structures in the form of, for example tanks and basements, reinforced concrete is an ideal building medium but in certain circumstances in the past difficulties have been encountered in casting the concrete in situ as, without constant supervision of a highly trained work force, the integrity of the cast concrete is not sufficiently high to ensure complete water-tightness.

The invention described in 9205677 overcame this disadvantage by utilising a plurality of pre-cast concrete elements which could guarantee the high degree of quality required. The pre-fabricated element comprised wall panels having cast integrally therewith base flanges and it has been found in certain instances that difficulties

have been encountered in correctly positioning the wall panels, especially in relation to each neighbouring panel, thus giving rise to sealing difficulties between adjacent panels.

It is an object of the present invention to obviate or mitigate this disadvantage together with the disadvantages encountered in building structures of this nature prior to the invention set out in our application 9205677.

According to the present invention there is provided a water-tight building structure comprising a peripheral foundation member having an upwardly directed channel, a waterproof membrane extending across the interior of the building structure, a plurality of pre-cast reinforced concrete wall sections, interconnecting means by which each of said wall sections can be drawn into closer contact with its neighbours, said wall sections each being located with its base in the channel and sealed therein in a watertight manner by a waterproof grouting material in the channel.

Further according to the present invention there is provided a water-tight building structure comprising a peripheral foundation member having an upwardly directed

channel, a waterproof membrane extending across the interior of the building structure at or above the level of the top of the foundation member, a plurality of pre-cast reinforced concrete wall sections, interconnecting means by which each of said wall sections can be drawn into closer contact with its neighbours, said wall sections each being located with its base in the channel and sealed therein in a watertight manner by a waterproof grouting material in the channel.

Preferably the wall sections are each pre-stressed in the, in use, top to bottom direction.

Preferably said interconnecting means include an arrangement spanning the joints between neighbouring wall sections and actuable to draw said sections together.

Said arrangement may include a wedge-like structure adapted to be forced into apertures in the sections.

Alternatively said arrangement may include a treaded assembly whose length reduces on actuation thereof.

Alternatively said interconnecting means include one or more passages through each wall section for the

reception of a tensioning member in the or each passage.

The foundation member may be cast in situ. Alternatively the foundation member comprises a plurality of slabs laid in end to end relationship. Preferably the slabs have water-tight sealing means on their facing faces.

When the foundation member is formed from slabs each slab may have one or more passages therethrough for the reception of a tensioning member in the or each passage by which a plurality of said slabs can be compressed together.

The slabs may have apertures therethrough by which they can be anchored to the ground by ties or piles. The waterproof membrane may be arranged at or above the level of the top of the foundation member. The waterproof membrane may extend across the channel member in the slabs so that it is sandwiched between the base of the channel and the base of the wall sections to enhance the waterproof joint.

Preferably after erection of the walls a concrete floor is cast on the waterproof membrane between the walls of the structure.

Preferably between each wall section and each slab of a pre-cast foundation member there is provided a sealing gasket. The gasket is preferably compressible and may be tacky.

Preferably the building structure is of rectangular configuration and corner wall sections having two limbs disposed at right-angles cast in situ. They may be prefabricated. In modifications the building stucture can be circular, octagonal, triangular or any other suitable configuration.

Central support columms or a central support wall may be mounted on a further foundation member laid within the building structure.

Preferably a roof is supported by the tops of the wall sections and a central column or wall. Preferably the roof includes prestressed pre-cast concrete beams and panels.

Preferably the grouting material is a synthetic latex cementitious grout. The latex may be a copolymer styrene butydyne.

According to a further aspect of the present

invention there is provided a method of forming a water-tight building structure comprising forming a peripheral foundation member having an upwardly directed channel therein, preparing the floor of the structure within the foundation and laying between the foundation member a waterproof membrane across said floor, erecting a surrounding wall on said foundation member from a plurality of pre-cast wall sections with the base of each section located in said channel, providing a water-tight joint between the base of each wall section and said channel and between neighbouring wall sections, arranging wall fixing tensionable members between said wall sections and applying tension to said members to compress said wall sections one against the other.

Preferably the method includes casting a continuous foundation member in situ.

Alternatively the foundation member comprises a plurality of pre-fabricated concrete slabs passing a tensionable member(s) through a passage(s) therethrough and the method includes laying the slabs around the periphery of the structure and holding the slabs against each other. The slabs may be held against each of by tensioning the member(s) to hold said slabs one against the other.

Preferably the enclosure is formed in a subterranean cavity which, at least during construction, is kept dry by means of a pump.

The structure may be provided with a roof.

The tensionable members may be extended through passages in said wall sections and may be tensioned hydraulically or manually. Preferably they are so arranged that they may be tensioned from externally of the enclosure. Tie bolts or piles may be inserted through the foundation member to fix it to the underlying strata to resist uplift.

Preferably a concrete floor which may include reinforcement is cast over the waterproof membrane between the erected walls.

Preferably during construction the wall sections are propped in position prior to the tension being applied to the tensioning members by adjustable props extending between the side of the excavated pit and each wall section.

An embodiment of the present invention will now be described by way of example only with reference to the

accompanying drawings in which:-

Fig. 1 shows a diagrammatic cross-sectional elevation through a part of a building structure forming a reservoir;

Fig. 2 shows a diagrammatic plan of the building structure;

Fig. 3 shows a diagrammatic cross-sectional elevation through part of a modified building structure forming a reservoir;

Fig. 4 shows a diagrammatic plan of a corner of the building structure shown in Fig. 3;

Fig. 5 shows a first modified tensioning member between wall sections of the structure, and

Fig. 6 shows a second modified tensioning member.

The embodiment to be described relates to a subterranean reservoir for drinking water but, as will be described hereinafter, the structure could equally well be constructed on the surface or could be a domestic, commercial or industrial basement or any other building

structure.

In the first instance a pit is excavated in which the reservoir has to be constructed. A sump 12 is formed in the pit so that water collecting therein during the construction of the reservoir can be pumped off by a surface mounted pump 14 and a riser 16. At the priphery of the building to be constructed a relatively shallow trench 11 is dug and the first step of the building operation is to lay on the floor 15 of the pit and of the trench 11 a layer or membrane 17 of a water impermeable material. A foundation member 22 extending around a periphery of the structure is then formed in the trench 22 either by casting it in situ or, as illustrated in Fig. 3, by forming it from a plurality of prefabricated concrete slabs 24. The foundation member has an open-topped channel 26 in its upper face.

Wall sections 40 can then be erected. These also are prefabricated reinforced members manufactured in controlled conditions to high degrees of integrity thereby ensuring their water-tightness. Each wall section 40 has compressible gasket means applied to its longer edges. Each eall section is prestressed in the, in use, top to bottom direction to reduce cracking due to the pressure of water filling the reservoir. The wall sections for a

relatively deep reservoir can comprise two sections as shown diagrametically in Fig. 1.

It is convenient in certain instances to cast the corners C and perhaps even the end walls E in situ. These walls are prestressed, cast by normal techniques on top of the foundation member 22 which, in those of its lengths supporting cast in-situ walls may be provided with an upstand and reinforcement connectors.

The cast in situ sections take up dimensional deviations and give the erected structure stability.

Prior to commencing the casting of cast in situ wall sections C and E the sections 40 are drawn towards each other to compress the gasket means thereby ensuring watertightness.

Various interconnecting means may be employed including wedge arrangements, turnbuckles, hydraulic or mechanical jacking means. Obviously they must not only compress the gasket by pulling one section 40 against its neighbour, but also permanently hold it in this location.

A suitable holding arrangement could be a spigot projection from the edge of one wall section which

penetrates a socket formed in the edge of the neighbouring wall section, the spigot having a rim near its leading end which, on entering the socket passes beyond a detent which then prevents removal of the spigot and maintains compressive forces on the gasket, Various other holding means could be employed. Fig. 5, by way of example shows diagrammatically a wedge mechanism 70 having inclined surface limbs 74 engaging in passages 76 in the wall sections near their edges.

A modified latex, cementitious grout is laid in the channel 26 prior to placing the base of a wall section 40 therein, the grout ensuring a water-tight seal between the wall section and the foundation member. The wall sections may be temporarily supported by adjustable length props 44 extending between the sections to and the pit wall.

A reinforced concrete slab 60 can then be cast on the layer or membrane 17 extending from wall to wall.

In the modification shown in Figs. 3 and 4 the foundation member is formed from a plurality of precast slabs with two relatively small diameter passages 28 extending horizontally therethrough and two or more larger diameter passages 30 extending vertically therethrough: After completing a length of foundation member from one

corner of the building structure to the other tensioning members 31 are passed through each passage and terminate at a corner L-shaped slab member 32 Fig. 4. A compressible water-tight gasket member (not shown) is provided on the end face of each slab section and it will be realised that after all the slab sections have been laid and the tensioning members fitted a force can be applied thereto either by mechanical or hydraulic means to pull each slab member against its neighbour to ensure the water-tight nature of the joint between slab members.

At this stage, if necessary, tie members or piles 34 can be driven through the vertically extending passages 30 to anchor the slab firmly to the ground and to provide vertical support if the ground conditions call for this.

The wall sections of the modified structure shown in Fig. 3 are similar to those of the Fig. 1 embodiment but are provided with horizontally extending passages 42 therethrough.

Prior to the placing of wall sections into the channel 26 in the foundation member a continuous water-tight membrane 50 is laid across the interior of the structure on a reinforced concrete slab 20 which was previously cast on the floor 15 of the pit to the level of

the foundation member 24. The membrane may extend into, across and out of the channel or may terminate at the inner edge of the channel.

In this modification at the corner of the structure there are provided L-shaped wall sections 46 (Fig. 2) and after erection of each wall steel tensioning members 48 are passed through the passages 42, fixed at one end, and tensioned either mechanically or hydraulically from the other end to draw the wall sections into close contact and enhance the sealing therebetween. When the entire wall has been constructed the support members 44 can be removed as it will be realised that at this stage the wall will be self supporting.

A further reinforced concrete slab 60 can then be cast in situ on the membrane 50.

The floor slab is preferably tied to the foundation member by interconnecting reinforcement.

In each embodiment a roof can be provided. Fig. 1 shows part of the roof. It comprises an edge member 80 which is similar to an inverted foundation member 24 and pre-cast, pre-tensioned roof slabs 82. If the the distance to be spanned by the roof slabs 82 is too great

they can be supported on intermediate pre-cast, pre-stressed beams 86 supported on columns 88.

As explained above a water impervious layer 17 or a membrane 50 can be used and the location of the membrane can be as illustrated in Fig. 3 or in the floor 15 of the pit as shown in Fig. 1 depending upon design considerations. The layer 17 could be formed from a material which, after absorbing water becomes impervious, for example VOLCLAY (Registered Trade Mark).

Mastic, sealant or caulking material can be applied by gun to joints between adjacent wall sections and/or between wall sections and foundation members and/or between foundation member and floor slab.

Claims:

1. According to the present invention there is provided a water-tight building structure comprising a peripheral foundation member having an upwardly directed channel, a waterproof membrane extending across the interior of the building structure, a plurality of pre-cast reinforced concrete wall sections, interconnecting means by which each of said wall sections can be drawn into closer contact with its neighbours, said wall sections each being located with its base in the channel and sealed therein in a watertight manner by a waterproof grouting material in the channel.

2. According to the present invention there is provided a water-tight building structure comprising a peripheral foundation member having an upwardly directed channel, a waterproof membrane extending across the interior of the building structure at or above the level of the top of the foundation member, a plurality of pre-cast reinforced concrete wall sections, interconnecting means by which each of said wall sections can be drawn into closer

contact with its neighbours, said wall sections each being located with its base in the channel and sealed therein in a watertight manner by a waterproof grouting material in the channel.

3. A structure as claimed in claim 1 or claim 2, in which said interconnecting means include an arrangement spanning the joints between neighbouring wall sections and actuable to draw said sections together.

4. A structure as claimed in claim 3, in which said arrangement includes a spigot and socket type assembly in which the spigot is captured in the socket after it has penetrated a predetermined depth into the socket.

5. A structure as claimed in claim 3, in which said arrangement includes wedge-like structure adapted to be forced into apertures in the sections.

6. A structure as claimed in claim 3, in which said arrangement includes a treaded assembly whose length reduces on actuation thereof.

7. A structure as claimed in claim 3, in which said interconnecting members include one or more passages through each wall section for the reception of a

tensioning member in the or each passage.

8. A structure as claimed in any one of the preceding claims, in which the foundation member comprises a plurality of slabs laid in end to end relationship.

9. A structure as claimed in claim 8, in which the slabs have water-tight sealing means on their facing faces.

10. A structure as claimed in any one of the claims 1 to 7 in which the foundation member is cast in situ.

11. A structure as claimed in claim 8 or 9, in which each slab has one or more passages therethrough for the reception of a tensioning member in the or each passage by which a plurality of said slabs can be compressed together.

12. A structure as claimed in claim 8, 9 or 11, in which the slabs have apertures therethrough by which they can be anchored to the ground by ties or piles.

13. A structure as claimed in any one of claims 2 to 12, in which the waterproof membrane extends across the channel member in the slabs so that it is sandwiched

between the base of the channel and the base of the wall sections to enhance the waterproof joint.

14. A structure as claimed in any one of claims 2 to 13, in which after erection of the walls a concrete floor is cast on the waterproof membrane between the walls of the structure.

15. A structure as claimed in any one of the preceding claims, in which between each wall section and each foundation member there is provided a seal.

16. A structure as claimed in any one of the preceding claims, in which the building structure is of rectangular configuration and corner wall sections having two limbs disposed at right-angles are provided.

17. A structure as claimed in any one of the preceding claims, in which the wall sections are pre-stressed in the, in use, top to bottom direction.

18. A structure as claimed in any one of the preceding claims, in which central support columns or a central support wall are mounted on a further foundation member laid within the building structure.

19. A structure as claimed in claim 18, in which a roof is supported by the tops of the wall sections and a central column or wall.

20. A structure as claimed in any one of the preceding claims, in which the grouting material is a synthetic latex cementitious grout.

21. A structure as claimed in claim 20, in which the latex is a copolymer styrene butydyne.

22. A method of forming a water-tight building structure comprising forming a peripheral foundation member having an upwardly directed channel therein, preparing the floor of the structure within the foundation and laying between the foundation members a waterproof membrane across said floor, erecting a surrounding wall on said foundation member from a plurality of pre-cast wall sections with the base of each section located in said channel, providing a water-tight joint between the base of each wall section and said channel and between neighbouring wall sections, arranging wall fixing tensionable members between said wall sections and applying tension to said members to compress said wall sections one against the other.

23. A method of forming a water-tight building structure

comprising forming a peripheral foundation member having an upwardly directed channel therein, preparing the floor of the structure within the foundation and laying between the groundation members at a level of the top of said members a waterproof membrane across said floor, erecting a surrounding wall on said foundation member from a plurality of pre-cast wall sections with the base of each section located in said channel, providing a water-tight joint between the base of each wall section and said channel between neighbouring wall sections, arranging wall fixing tensionable members between said wall sections and applying tension to said members to compress said wall sections one against the other.

24. A method as claimed in claim 22 or 23, casting a continuous foundation member in situ.

25. A method as claimed in claim 22 or 23, in which the foundation member comprises a plurality of pre-fabricated concrete slabs each having a passage or passages therethrough and foundation fixing tensionable members are passed through said passage(s) and tensioned to compress said slabs one against the other.

26. A method as claimed in any one of claims 22 to 25, in which the tensionable members are extended through

passages in said wall sections and are tensioned hydraulically or manually.

27. A method as claimed in any one of claims 22 to 26, in which piles may be inserted through the foundation member to fix it to the underlying strata to resist uplift.

28. A method as claimed in any one of claims 22 to 27, in which a concrete floor which includes reinforcement is cast over the waterproof membrane between the erected walls.

29 A water-tight building structure substantially as hereinbefore described with reference to Figs. 1 and 2 or figs. 3 and 4 or Fig. 5 of the accompanying drawings.

30. A method of constructing a building structure substantially as hereinbefore described with reference to Figs. 1 and 2 or Figs. 3 and 4 or Fig. 5 of the accompanying drawings.

31. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

Patents Act 1977
Examiner's report to the Comptroller under section 17 (The Search Report)

Application number
GB 9314360.0

Relevant Technical fields

(i) UK Cl (Edition L) E1D (DDP,DF185,DGS) E1T

(ii) Int Cl (Edition 5) E02D, E04H

Search Examiner
D J LOVELL

Databases (see over)
(i) UK Patent Office

(ii)

Date of Search
4.10.93

Documents considered relevant following a search in respect of claims 1-30

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2234544 A (McCLOSKEY) note liner 22	1,2,22,23 at least
Y	GB 2177447 A (DEWEY WATERS & CO LTD) note membrane 14	"
Y	GB 2062079 A (SPILLANE) note membrane 19	"
Y	GB 2049781 A (BTR INDUSTRIES INC) note membrane 16)	"
Y	US 4142339 (CROWLEY)	"
Y	US 4126976 (CROWLEY)	"
Y	US 4015383 (CROWLEY)	"
Y	US 3824751 (SHELANDER)	"

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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